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May 21, 1974

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United States Atomic Energy Commission
Attention: Mr. R. J. Hart, Manager, ORO
Post Office Box E
Oak Ridge, Tennessee 37830

Gentlemen:

Operating Limits - Radioactive
Materials Released to the Environment

In response to Mr. Lenhard's letter of March 28 to multiple addressees, the attachments are submitted regarding current operating limits at UCC-ND-operated facilities for the release of radioactive materials to the environment.

We would be pleased to discuss the matter of operating limits with members of your staff to assure conformance with AECM and ORIAD 0511.

Very truly yours,

R. F. Hibbs, President

RFH:ayb

Attachments

cc: P. C. Fournery - 2
C. J. Parks - 4
H. Postma
P. R. Vanstrum - 2

APPROVAL FOR RELEASE

Unnumbered 1 page letter & 13 pages attachments
Document: # _____, Date 5/21/74

Title/Subject RF Hibbs to RJ Hart (AEC-ORO), "Operating Limits - Radioactive Materials Released..."

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Kevin S. Smith
K-25 Classification & Information Control Officer

1/29/93
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Oak Ridge Gaseous Diffusion Plant

1. Quantities and types of radioactive materials placed in burial grounds.

The ORGDP has one disposal area used only for the burial of radioactive material. There are no set limits on the quantities which may be buried. However, the quantities buried within a certain grave or section must be governed by nuclear safety considerations. Types of material buried in the area are low-grade, impure oxide material (U_3O_8 , UO_2 , or UO_3) which is less than normal assay; contaminated containers; and leached alumina from the alumina traps in the process cascade. The uranium has been leached from the alumina to the lowest practicable limit.

2. Liquids released to streams, pits, settling basins, etc.

There are no specific operating limits for quantities or concentrations of radioactive materials discharged to such areas.

3. Gases released to atmosphere.

There are no specific operating limits for quantities or concentrations of radioactive materials discharged in the gaseous effluents.

Environmental monitoring data have indicated that the Oak Ridge Gaseous Diffusion Plant's discharge of radioactive material to the environment has resulted in concentrations well within the requirements set forth in AEC Appendix 0524, Standards for Radiation Protection. Discharges have continually been held to a minimum, and future plans call for equipment and operating modifications which will result in a further reduction in the concentrations. The ORGDP's radioactive waste management programs and the results of effluent and environmental sampling programs have been submitted in various reports to the AEC.

Oak Ridge National Laboratory

1. Quantities and types of radioactive materials placed in burial grounds.

There are no set limits for the total quantities and types of radioactive materials placed in the burial grounds. However, there are rules governing the placement of radioactive material in the burial grounds to keep to a practical minimum the radioactive materials released to the environment. These may be summarized as follows (they are covered in more detail in the operating procedures, now in development):

- a. Wastes containing transuranium isotopes or ^{233}U in amounts exceeding $10\ \mu\text{Ci/kg}$ are stored retrievably as required by AEC 0511-044d(4).
- b. Limits on off-site shipments received for disposal at ORNL are determined on an individual basis and with the concurrence of AEC-ORO.
- c. Fissile materials are stored: (1) in retrievable storage, in approved containers not to exceed $5\ \text{g}$ fissile isotopes/ ft^3 or $200\ \text{g/container}$; (2) in auger holes, retrievable and nonretrievable, not to exceed $200\ \text{g/auger hole}$; or (3) in bulk quantities (trench burial), not to exceed $1\ \text{g/ft}^3$. For values above these, approval of the ORNL Criticality Committee is required.
- d. Retrievable waste ($>10\ \mu\text{Ci}$ of ^{233}U or transuranic isotopes/kg of waste) packages must contain no liquids, no corrosives that will corrode through container, no explosives, no pyrophoric materials.
- e. No radioactive gases under pressure are stored or buried.
- f. Large quantities, requiring shielding or special handling, of radioactive material are reviewed on an individual package basis for proper storage or disposal.
- g. All waste is stored at least one foot above the water table.
- h. Radioactive liquids (oils, other) are buried only when they cannot be disposed of any other way at ORNL.

2. Liquids released to streams, pits, settling basins, etc.

- a. Clinch River - The final release point of all ORNL off-site liquid waste discharges is White Oak Dam. The receiving stream is the Clinch River. Under normal conditions, ORNL's discharges are operationally limited to result in less than the maximum permissible concentration for radioactive contaminants in an unrestricted body of water (MPC_W), the Clinch River. The highest annual average concentration in the Clinch River resulting from ORNL discharges occurred in 1960. It was 25% of MPC_W . In the last five years, the annual average concentration has been below 0.5% of MPC_W .
- b. Process Waste Treatment Plant - The plant is only 80% efficient in its removal of ^{90}Sr , the main contaminant released to the Clinch River, and more than 95% efficient in the removal of alpha contaminants. Although

there has never been a discharge into the system that was so high that the river would become seriously contaminated because of the low efficiency of the plant, it is conceivable that an accidental, high release could take place which would seriously contaminate the river. To prevent this from happening, a limit has been set on the amount of radioactive material that will be taken into the plant for treatment in the event of a high release into the system. Above that limit, the waste will be pumped, bypassing the plant, to the emergency holding pond.

The maximum amount of radioactivity that will be processed through the Process Waste Treatment Plant is 50 curies of ^{90}Sr or an equivalent of other beta and gamma activity, or 50 curies of ^{239}Pu or an equivalent of other alpha activity. How this amount of activity will affect the concentration in the river will depend on the river flow at the time of the incident. Based on past experience, it would be reasonable to assume that an accidental, high release into the process waste system would stretch out into a relatively high discharge into the river for at least one week. Assuming that the rate of release into the river is uniform and the flow is normal at $4600 \text{ ft}^3/\text{sec}$, the maximum release to the river would result in a concentration of activity in the river of 50% of MPC_W .

- c. Process Waste Sludge - Waste pit No. 4 currently is used for disposal of lime-soda ash sludge from the Process Waste Treatment Plant. Approximately ten curies of ^{90}Sr and three curies of other fission products are dumped into the pit annually. No discharge limits have been placed on the activity being put into the pit with the sludge because the operation adds an insignificant amount of activity when compared to the many thousands of curies disposed of at that location, with intermediate-level waste, years ago; also, because the disposal of the sludge will be discontinued in December 1975 when the new Process Waste Treatment Plant is put into operation.
- d. Shale Fracturing Disposal of Intermediate-Level Waste - The specific activity of waste solution that is disposed of by the shale fracturing facility is limited to a maximum of 2 Ci/gal beta and gamma activity and 5×10^{-3} Ci/gal transuranic activity. The limit on the beta and gamma activity was set to keep the exposure of personnel during inspection and maintenance operations within acceptable limits. The limit on transuranic activity was set to keep the concentration in the grout-shale disposal zone below $10 \text{ } \mu\text{Ci/kg}$ and to keep the concentration of transuranics in the ventilation system at a safe level. Originally, the transuranic activity in the waste solution was limited to a maximum of 2×10^{-3} Ci/gal (ORNL-4665). Subsequent analyses of grout sheet thicknesses, however, showed that a concentration of 10×10^{-3} Ci/gal would be required for the concentration in the zone to reach $10 \text{ } \mu\text{Ci/kg}$.

3. Gases released to atmosphere.

The releases of airborne radioactivity at ORNL are limited so that the concentrations in the air at the boundary of the controlled area will not exceed the applicable Standards for Radiation Protection, AECM 0524. This is accomplished by continuous stack monitors and stack inventory samples, the results from which are compared to derived operating limits. An example, those limits for ^{131}I , considered to be the only isotope of potential concern, stipulate that the weekly total for ORNL not exceed 1.0 curie, averaged over a period of 13 weeks, with no peak value for any week to exceed 3.0 curies. Actual performance is far below this limit; the totals for the year 1972 being 1.1 curie for Stack 3039 and 0.6 curie for Stack 7911. Similarly, values experienced for noble gases, based on conservative calibration techniques, indicate releases of the order of less than one percent of the applicable limits. The inventory samples are also analyzed for other mixed fission product particulates to determine any need for corrective action to contributing processes. Their average discharge is less than 0.5 millicurie per week.

Oak Ridge Y-12 Plant

Disposal of Surplus and Waste Materials and Equipment

To prevent the release of radioactive or toxic materials to nonprocessing areas within the plant or to the general public, checks for contamination are made on all equipment, materials, and scrap which are salvaged or sold to the public. It is Company policy to offer for sale to the public only those materials which are not contaminated or which are within the AEC permissible limits for contamination. Limits and procedures for the proper disposal of such materials are specified in an internal procedure.⁽¹⁾ It is the responsibility of the Material Control Department to offer only those items of surplus material for sale to the public which fall within the established procedures and regulations.

Hazardous chemicals, gases, and radioactive wastes are disposed of according to internal procedures.⁽²⁾ The Radiation Safety Department makes appropriate investigations and submits recommendations and advice to the Maintenance Division which completes the arrangements for disposal.

All surplus or waste materials and equipment are disposed of through channels as diagrammed in Figure 1, using the suggested limits for waste disposal as given in Table 1 as guides.

Contaminated Material Disposal Locations

Contaminated materials or equipment may be sent to one of the following locations, depending on their usefulness and the degree and type of contamination.

S-3 Acid Ponds - Four disposal ponds are located at the west end of the Y-12 Plant. These ponds are holding ponds for acid waste and do not flow directly to a receiving stream.

Used Stores - Some items of equipment that appear to have further usefulness are retained by Used Stores and made available for plant use. Such items are properly tagged to indicate the type and amount of contamination.

Storage Yard - Contaminated scrap metals are stored in the storage yard for future sale.

Y-12 Burial Grounds

The Y-12 Plant has three burial areas. (See Figure 2)

1. Yard 1-A is used for burying low-level (or < 10% by weight of normal uranium) materials.
2. Large lots of uranium which may be accountable or reclaimable are put into Yard 2-B.

(1) UCC-ND Standard Practice Procedure D-2-5, "The Sale of Contaminated Materials".

(2) Y-12 Plant Standard Practice Procedure No. 68, "Disposal of Hazardous Chemicals, Gases, and Radioactive Wastes".

3. Material contaminated with medium-level contamination (equivalent to 100% normal uranium) is disposed of in Yard 2-C. This yard is also used for the disposal of thorium- and beryllium-contaminated materials.

X-10 Burial Ground

Contaminated materials that cannot be disposed of in any of the other areas are sent to the X-10 Burial Ground. Some elements with the limits that require burial at X-10 are:

Uranium - $> 1.5 \times 10^6$ d/m/g

Thorium - $> 3.4 \times 10^5$ d/m/g

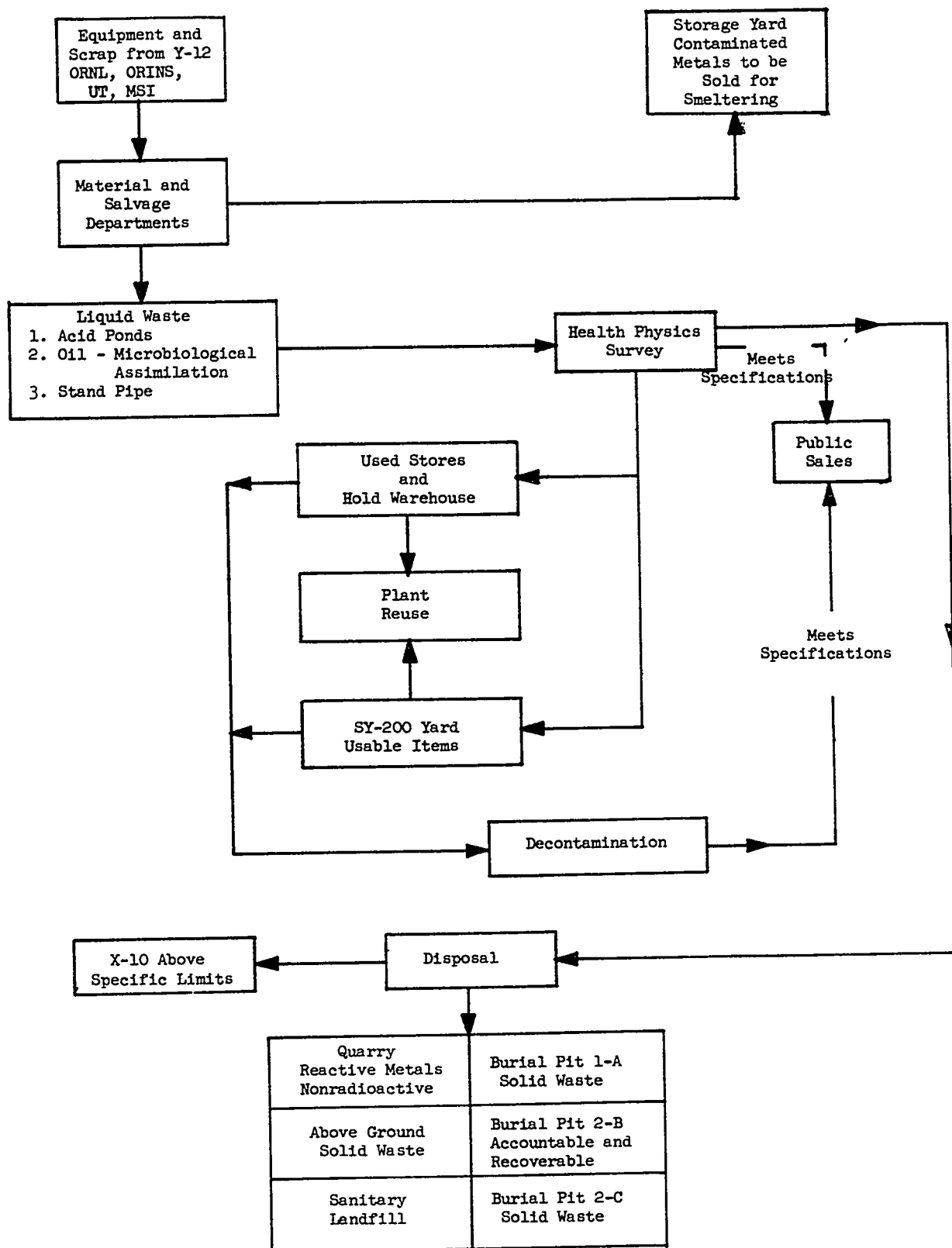
Plutonium - any detectable

Neptunium - any detectable

Beryllium - $> 2 \times 10^4$ μ g/g

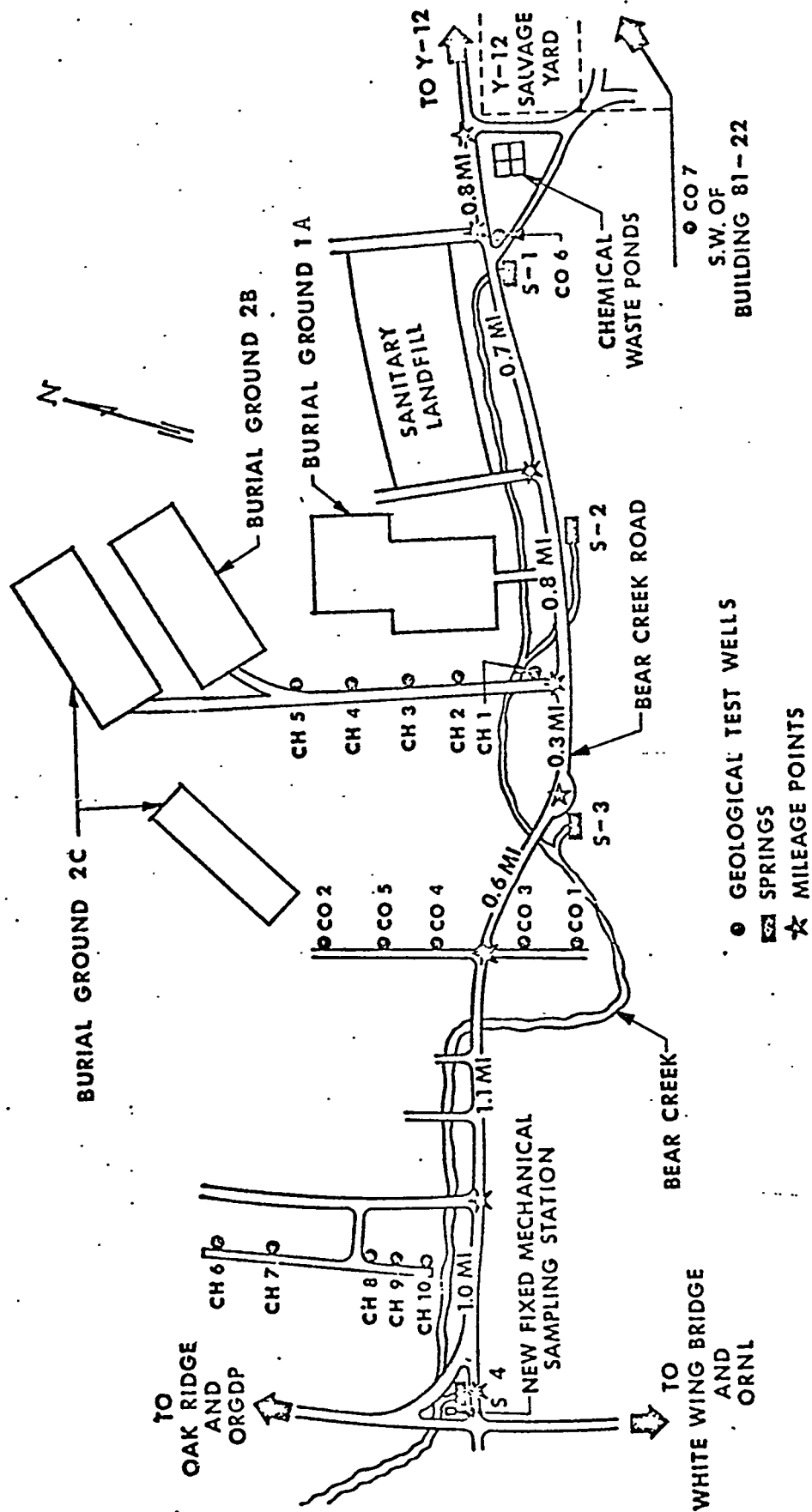
All other materials with high specific activity and/or high health-hazard index.

Attachments



CHANNELS FOR SURPLUS AND WASTE MANAGEMENT Y-12 PLANT

FIGURE 1



SCHEMATIC DIAGRAM OF BEAR CREEK AREA

Figure 2

Table 1

Y-12 PLANT

GUIDE LINES FOR WASTE DISPOSAL

Location	Contaminant	Limits		Comments
		Homogeneous Mixture	Surface Reading	
<u>Solids</u>				
Above-Ground Storage	U	$< 2.7 \times 10^{-3} \mu\text{Ci/gm}^{(2)}$	$< 3.5 \text{ mrad/hr}$ - Beta, Gamma $1.1 \times 10^{-2} \mu\text{Ci}/100\text{cm}^2$ - Alpha	For the storage of voluminous quantities of materials which are not economical to bury. (Scrap Metals)
Burial Ground 1-A	U	$< 0.068 \mu\text{Ci/gm}^{(2)}$	$< .068 \mu\text{Ci}/100\text{cm}^2$ No limit on Beta + Gamma as long as they are associated with uranium.	For the disposal of materials containing up to 10% by weight depleted uranium.
Burial Ground 2-B	U	$< 0.68 \mu\text{Ci/gm}^{(2)}$	No limit as long as the radiation is associated with uranium.	For the disposal of depleted uranium which may be accountable ⁽¹⁾ and/or recoverable.
Burial Ground 2-C	U	$< 0.68 \mu\text{Ci/gm}^{(2)}$	No limit as long as the radiation is associated with uranium.	For the disposal of enriched uranium contaminated materials which are not recoverable. ⁽¹⁾
	Th	$< 0.15 \mu\text{Ci/gm}^{(2)}$	No specified limit	Thorium and beryllium greater than specified limits are disposed of at the ORNL Burial Ground.
	Be	$< 2 \times 10^4 \mu\text{g/gm}^{(2)}$	No specified limit	
ORNL Burial Ground	All Contaminants	No upper limits	No upper limits	Materials which exceed limits for Burial Areas 2-B or 2-C. ⁽¹⁾

⁽¹⁾ Requires Form UCN-2109⁽²⁾ Average amount of contaminant per unit weight

Table 1

Y-12 PLANT

GUIDE LINES FOR WASTE DISPOSAL (cont'd)

Location	Contaminant	Limits		Comments
		Homogeneous Mixture	Surface Reading	
<u>Liquids</u>				
Acid Pits (S-3 Ponds)	U	< 0.68 $\mu\text{Ci/gm}^{(1)}$ Average concentration of water in pit not to exceed $2.7 \times 10^{-3} \mu\text{Ci/ml}$.		Disposal of waste in water or acid solution.
Oil Farm	U and Th Be	< 0.068 $\mu\text{Ci/gm}^{(1)}$ < $2 \times 10^4 \mu\text{gs/gm}^{(1)}$		Contaminated machine oils - Disposed of by biodegrading.
Liquid Salvage Sump (Y-12 Burial Ground 1-A)	Be	< $2 \times 10^4 \mu\text{gs/ml}$		For the disposal of Be-contaminated liquid.
	Th	$7.3 \times 10^5 \mu\text{gs/ml}$		
ORNL Burial Ground	All contaminants	No upper limits		Materials which exceed limits for Acid Pit or Burial Ground 2-C.
Plant Ambient Air	U and Th	< $0.24 \times 10^{-6} \mu\text{Ci/M}^3$		Plant Air Monitoring Network.
New Hope Pond	U	$3.0 \times 10^{-5} \mu\text{Ci/ml}$		Uranium solutions may be disposed of in creek as long as they are in such quantity and released at such a rate that the creek concentration does not exceed $3.0 \times 10^{-5} \mu\text{Ci/ml}$ alpha. Other materials should not be disposed of in this manner.

(1) Requires Form UCN-2109

(2) Average amount of contaminant per unit weight

Paducah Gaseous Diffusion Plant

1. Quantities and types of radioactive materials placed in burial grounds.

- a. C-749 (Uranium Scrap Burial Ground) - There are no set limits on quantities. Types of material consigned to this burial area consist of depleted uranium-bearing scrap deemed undesirable to store in the open pit area. The material is primarily pyrophoric uranium metal in the form of sawdust, shavings and turnings. Miscellaneous uranium-bearing scrap metals include uranyl fluoride solutions, contaminated trichloroethylene, U-Zr alloys, slag, crucible burnout and U_3O_8 .
- b. C-404 (Solid Radioactive Waste Disposal Area) - There are no set limits on quantities. Types of material consigned to this area includes depleted Metals Plant scrap (reject slag, vacuum cleanings, black oxide, ball mill reject, reject liner, duds, and crucible burnout), scrap mostly depleted from Chemical Processing (filter cake, reject UF_4 , sludges, and miscellaneous other solids economically unworthy of recovery), and other miscellaneous solids ineligible for recovery, such as sewage plant sludge, laboratory waste and contaminated slag from the aluminum smelter.
- c. In addition to these areas, there are several burial plots in which miscellaneous uranium-contaminated scrap metal and equipment have been placed. The associated uranium is either depleted or trace amounts left after decontamination were in excess of that permitted for salable contaminated scrap and further decontamination was not practical.

2. Liquids released to streams, pits, settling basins, etc.

- a. C-404 (Holding Pond - converted to solid waste disposal in 1957) - This area was used from February 1953 through February 1957 as an equalization and holding pond for liquid uranium waste primarily from uranium decontamination and recovery operations. The concentration limit for uranium-bearing solutions discharged to the pond was 500 ppm. The overflow from the holding pond during this period was to the Ohio River via Big Bayou Creek. While there was no specific assay limit, the ^{235}U content is approximately that of normal uranium.
- b. C-400 (Uranium Decontamination and Recovery Waste Raffinate Solution discharged to Ohio River via Little Bayou Creek) - This method of disposal of this liquid waste has been used since February 1957. The concentration limit for uranium-bearing solutions discharged is 500 ppm. While there is no specific assay limit, the ^{235}U content is approximately that of normal uranium.

3. Gases released to atmosphere.

There are no specific operating limits for quantities or concentrations of radioactive materials released to the atmosphere.

Environmental monitoring data over the years have indicated that the Paducah Plant's discharge of radioactive materials to the environment has resulted in radioactive concentrations well within the requirements of AEC Appendix 0524, Standards for Radiation Protection. Additional reductions have been made in some cases in view of limiting contributions to the environment. Discharges to the streams and atmosphere have continually been held as low as practicable. The PGDP waste disposal practices have been included in various reports to the AEC.

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AUTHORS: NO AUTHOR GIVEN

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